Message

From: Smallbeck, Donald R. [Donald.Smallbeck@amecfw.com]
Sent: 5/11/2017 4:10:08 PM
To: Wayne Miller [Miller.Wayne@azdeq.gov]; JERRARD, CATHERINE V CIV USAF HAF AFCEC/CIBW [catherine.jerrard@us.af.mil]; Pearson, Stuart C. [Stuart.Pearson@amecfw.com]
CC: d'Almeida, Carolyn K. [dAlmeida.Carolyn@epa.gov]; Davis, Eva [Davis.Eva@epa.gov]; d p [DPope@css-dynamac.com]; steve [steve@uxopro.com]
Subject: RE: 2017-4-4 - Williams AFB - ADEQ evaluation of AMEC 3-29-2017 E-mailed responses to Agency comments - SPearson AMEC follow up to the Mar 16 2017 BCT Call - ST012 EBR -

Wayne

Thank you for the evaluation and recommendations. Please find below Air Force/Amec Foster Wheeler follow up responses in blue text.

D.R. Smallbeck
Principal Program Manager
Construction Remediation

Amec Foster Wheeler
4600 E Washington Street, Suite 600
Phoenix, Arizona 85034
Tel: 602-733-6040
Cell: 707-480-7212
Donald.Smallbeck@amecfw.com
amecfw.com

From: Wayne Miller [mailto:Miller.Wayne@azdeq.gov]
Sent: Tuesday, April 04, 2017 1:35 PM
To: JERRARD, CATHERINE V CIV USAF HAF AFCEC/CIBW; Pearson, Stuart C.; Smallbeck, Donald R.
Cc: Carolyn dAlmeida (dAlmeida.Carolyn@epamail.epa.gov); Davis, Eva (Davis.Eva@epa.gov); Dan Pope; steve
Subject: 2017-4-4 - Williams AFB - ADEQ evaluation of AMEC 3-29-2017 E-mailed responses to Agency comments - SPearson AMEC follow up to the Mar 16 2017 BCT Call - ST012 EBR -

Stu – Thank you for stepping in to assist Don and Cathy. ADEQ appreciates the effort USAF and AMEC put forth in the March 2017 Base Closure Team (BCT) presentation and to responding to Agency comments. ADEQ and our contractor UXO Pro, Inc. evaluated AMEC's March 29, 2017-emailed response to comments [RTCs] to agency-posed questions/comments during the March 16, 2017 Base Closure Team (BCT) conference call. Our evaluation provides our perspective and includes some embedded recommendations which we believe will benefit the mutual goal toward achieving aquifer restoration. ADEQ's evaluation follows:

2. Question on the amount of LNAPL removed from inside vs. the TTZ perimeter or outside the TTZ.

AMEC Response (3-29-2017)

a. It was clarified during the call that the statement on the slide was intended to characterize the entire post SEE period rather than just the period since the January BCT call.
b. During the period from 13 Jan through 17 March approximately 600 gallons of LNAPL was removed. In the UWBZ approximately 8 gallons came from interior wells out of 109 gallons removed. In the LSZ approximately 237 gallons came from the interior out of 485 gallons removed. (note: we do not account for LSZ16 as an interior well in these estimates based on the lack of another well positioned between LSZ16 and the TTZ perimeter)

ADEQ Evaluation (2a,b – 4-4-2017)

For the period 13 Jan through 11 March, Slide 8 and its legend indicate the total NAPL volume removed from the UWBZ was about 100 gallons including UWBZ01 (25 gal), UWBZ05 (5 gal), UWBZ06 (4 gal) and UWBZ20 (68 gallons). The first three wells are located in the TTZ directly between former steam injection wells. UWBZ20 is located directly west of former steam injection wells UWBZ13 and UWBZ15 on the edge of the TTZ as defined in the Work Plan. In addition, UWBZ15 has consistent NAPL detections including 1.5 feet on 1/27/17 and previous NAPL removal despite its use as a steam injection well. Based on these observations, the majority of the NAPL recovered in the cited period came from the interior and edge of the designed TTZ.

For the period 13 Jan through 11 March, Slide 10 and its legend indicate the total NAPL volume removed from the LSZ was about 485 gallons. Of this total, about 25% was recovered from LSZ30 located in the middle of four former steam injection wells. Well LSZ16 is located between former steam injection wells LSZ03 and LSZ18 and former SEE extraction well LSZ28 is located to the northwest on the perimeter placing LSZ16 in the interior of the TTZ. Approximately 120 gallons were removed from this well indicating 357 of 485 gallons were recovered from the TTZ interior of the LSZ. Based on these observations, the majority of the NAPL recovered in the cited period came from the interior of the TTZ.

AF/AmecFW follow up response:
There is a difference in how AMEC/AF identifies perimeter wells versus how ADEQ identifies perimeter wells for this metric. AMEC/AF considers wells around the perimeter of the TTZ that could be affected by LNAPL migration from outside the TTZ toward the TTZ (especially during the extraction period following steam injection) as perimeter wells. If this metric continues to be reported, future presentations will show the TTZ boundary and color code the wells identified as interior wells versus those identified as perimeter wells for the purposes of LNAPL recovery.

3. Request to include baseline microbiological testing.

AMEC Response (3-29-2017)

a. The addition of baseline qPCR and PLFA will be added for six wells to baseline sampling prior to EBR injections. This will include two wells in each of the three zones (CZ, UWBZ, and LSZ) and will be the same wells proposed for subsequent testing post injections.

ADEQ Evaluation (3a – 4-4-2017)

The addition of pre-EBR baseline samples is appropriate. At least one sample from each zone needs to be collected from within the Thermal Treatment Zone close to a known LNAPL area, preferably in an area that saw significant heating during SEE, but which has cooled enough (i.e., <140°) to install the BioTrap sampler.

AF/AmecFW follow up response:
The potential locations as proposed by ADEQ will be evaluated and considered during data evaluation for EBR baseline sampling.

AMEC Response (3-29-2017)

b. SIP analysis is not proposed. The primary purpose of SIP is to demonstrate that carbon atoms from contaminants are incorporated into cell mass and dissolved inorganic carbon to prove degradation is occurring. A positive result is desired during EBR but comparison to a baseline result is irrelevant to the purpose of the test.

ADEQ Evaluation (3b – 4-4-2017)

A positive result is needed before implementing EBR to show that a population of target-compound degraders is present. qPCR and PLFA won't be able to confirm the presence of active biodegradation in-situ like SIP. EBR is "Enhanced BioRemediation"; bioremediation is already occurring, but we're just enhancing it and making it more effective and robust. If there is no positive SIP result prior to EBR, then it's likely the desired degrading microbes may not be there, and we need to couple our decision with available PLFA and qPCR data and consider the need for

bioaugmentation. Since both PLFA and SIP analyses can be conducted from a single BioTrap sampler, it makes sense to run both analyses.

AF/AmecFW follow up response:
If the desired degrading population (e.g., SRBs) is present but is limited by TEA (e.g., sulfate) the SIP result may be negative, it but would not indicate a need for bioaugmentation. Based on the potential for inconclusive results from pre-implementation SIP sampling, there is not a technical basis for its inclusion. The fact that both tests can be conducted from a single sampler does not factor into the technical basis for performing SIP testing. The SIP sampling conducted during EBR will provide evidence of degradation and identification of the degrading populations(s).

5. Discussion on incorporation of an LNAPL transfer limitation as was used in the SEAM3D code

AMEC Response 3-29-2017

a. The site-specific LNAPL mass transfer determined during the TEE pilot was based on a continuous active pumping situation without biological enhancement. Although pumping is included in the EBR approach it is primarily for sulfate distribution over a period of several weeks after which pumping ceases. Enhancement of dissolution by biosurfactants is also expected to occur which would have a positive effect on LNAPL mass transfer which is not accounted for in the TEE pilot determination.

b. The MODFLOW-SURFACT code is sufficient as an engineering tool for the purposes of establishing a baseline estimate of EBR performance and duration and evaluating optimization approaches as EBR proceeds. The model will be updated based on actual monitoring results and LNAPL dissolution can be adjusted, if necessary, by adjusting solubility parameters. Other parameters that may affect EBR performance will be adjusted based on monitoring results.

ADEQ Evaluation (5a,b – 4-4-2017)

The mass transfer coefficients determined during the TEE pilot test provide optimistic estimates for modeling EBR. Mass dissolution is the product of the mass transfer coefficient and the concentration gradient that exists between NAPL and the bulk of surrounding water. Higher flow rates increase the mass transfer coefficient and increase the concentration gradient. On the scale of modeling (several feet), the NAPL and water may be near equilibrium when the flow rate is low (i.e., the residence time of water in a given volume is long allowing near equilibrium conditions). The high flow rates during the mass transfer test created dis-equilibrium by lowering the residence time to allow a determination of the mass transfer coefficient. The EBR process is different in that mass transfer from the NAPL will be promoted by increasing the concentration gradient, with no change in the existing mass transfer coefficient (unless the biosurfactant effect is appreciable). If successful in rapidly degrading the dissolved phase concentration, the dissolution rate will become limited by the mass transfer coefficient between the NAPL and bulk surrounding water.

AF/AmecFW follow up response:
There are advantages and disadvantages associated with each approach. As stated in the response above, the updates to the model based on actual monitoring results and LNAPL dissolution can be adjusted, if necessary, by adjusting solubility parameters. Other parameters that may affect EBR performance will be adjusted based on monitoring results. It is expected that the biosurfactant effect will be appreciable.

Thank you.

Wayne Miller
Arizona Department of Environmental Quality,
Waste Programs Division,
Remedial Projects Section,
Federal Projects Unit

Email: Miller.wayne@azdeq.gov
Phone: 602.771.4121

Arizona Department of Environmental Quality,
1110 West Washington Street
Phoenix, AZ 85007

From: Pearson, Stuart C. [mailto:Stuart.Pearson@amecfw.com]
Sent: Wednesday, March 29, 2017 11:03 AM
To: d'Almeida, Carolyn K. <dAlmeida.Carolyn@epa.gov>; Wayne Miller <Miller.Wayne@azdeq.gov>
Cc: MOOK, PHILIP H JR GS-15 USAF AFCEC AFCEC/CIBW <philip.mook@us.af.mil>; Anderson, Scott J <Scott.Anderson@amecfw.com>; Davis, Eva <Davis.Eva@epa.gov>; Dan Pope <DPope@css-dynamac.com>; steve@uxopro.com; Willis, Shannon (Arizona) <shannon.willis2@amecfw.com>; Bo Stewart <bo@praxis-enviro.com>; Henning, Loren <Henning.Loren@epa.gov>; Brasaemle, Karla <KBrasaemle@TechLawInc.com>; Rohrbaugh, Amanda <ARohrbaugh@TechLawInc.com>; Guerra, Peter A <Peter.Guerra@amecfw.com>; Smallbeck, Donald R. <Donald.Smallbeck@amecfw.com>; JERRARD, CATHERINE V CIV USAF HAF AFCEC/CIBW <catherine.jerrard@us.af.mil>
Subject: 2017-3-29 - WAFB - responses to Agency comments - March 16 2017 BCT Call Follow Up - ST012 EBR - spearson amec for dsmallbeck

BCT members,

Please see below for responses to comments and questions that came up during our March BCT call. Cathy has reviewed and concurred on the responses. I am sending the message as she currently does not have access to email and Don is traveling.

1. Difference in LNAPL extent characterization in the Cobble Zone between the Draft Final Addendum 2 (Figure B-1) and Figures 1&2 recently distributed before the BCT call.

   a. The presence of LNAPL in the CZ at LSZ23 was interpreted based positive dye tests at depths of 135 and 165 ft bgs (i.e., above and below the CZ). The original LNAPL interpretations assumed positive dye test kits applied to all depths below the test depth until the next dye test result was encountered (very conservative approach). At LSZ23 the PID readings were 2,258 ppmv at 135 ft bgs but decreased to 8.1 ppmv at 145 ft bgs (the approximate top of the CZ). PID values at LSZ23 increased to 1,300 at 160 ft bgs. PID readings indicate that the positive dye tests at 135 ft and 165 ft should not be interpreted that residual LNAPL is continuously present in the CZ. When LNAPL extents were updated follow the EBR drilling, previous boring logs were reviewed and LNAPL interpretations were updated to consider PID readings.

2. Question on the amount of LNAPL removed from inside vs. the TTZ perimeter or outside the TTZ.

   a. It was clarified during the call that the statement on the slide was intended to characterize the entire post SEE period rather than just the period since the January BCT call.
   b. During the period from 13 Jan through 17 March approximately 600 gallons of LNAPL was removed. In the UWBZ approximately 8 gallons came from interior wells out of 109 gallons removed. In the LSZ approximately 237 gallons came from the interior out of 485 gallons removed. (note: we do not account for LSZ16 as an interior well in these estimates based on the lack of another well positioned between LSZ16 and the TTZ perimeter)

3. Request to include baseline microbiological testing.

   a. The addition of baseline qPCR and PLFA will be added for six wells to baseline sampling prior to EBR injections. This will include two wells in each of the three zones (CZ, UWBZ, and LSZ) and will be the same wells proposed for subsequent testing post injections.
   b. SIP analysis is not proposed. The primary purpose of SIP is to demonstrate that carbon atoms from contaminants are incorporated into cell mass and dissolved inorganic carbon to prove degradation is occurring. A positive result is desired during EBR but comparison to a baseline result is irrelevant to the purpose of the test.

4. Comment on calculated kd being excessively low where foc values are low.

   a. Kd values utilized in the EBR model are based on values previously used for the site based on actual field data.
   b. If Kd values were higher as suggested by the comment, it would result in reduced concentration dissolved phase concentrations. By utilizing a higher Kd value in the model, the model would show achieving conditions where the flux of contaminants into dissolved groundwater is addressed by the background flux of TEA sooner than currently predicted by the model (i.e., the current model is sufficiently conservative)
   c. The overall mass at the site is dominated by the LNAPL. The additional sorbed mass associated with a higher kd would not result in a significant change in the overall mass at the site. This is an important consideration; Kd is the equilibrium constant between dissolved and solid phases which both represent a small fraction of the total mass in the presence of LNAPL.

5. Discussion on incorporation of an LNAPL transfer limitation as was used in the SEAM3D code

   a. The site-specific LNAPL mass transfer determined during the TEE pilot was based on a continuous active pumping situation without biological enhancement. Although pumping is included in the EBR approach it is primarily for sulfate distribution over a period of several weeks after which pumping ceases. Enhancement of dissolution by biosurfactants is also expected to occur which would have a positive effect on LNAPL mass transfer which is not accounted for in the TEE pilot determination.
   b. The MODFLOW-SURFACT code is sufficient as an engineering tool for the purposes of establishing a baseline estimate of EBR performance and duration and evaluating optimization approaches as EBR proceeds. The model will be updated based on actual monitoring results and LNAPL dissolution can be adjusted, if necessary, by adjusting solubility parameters. Other parameters that may affect EBR performance will be adjusted based on monitoring results.

Stuart Pearson, P.E.
Senior Associate Engineer, Amec Foster Wheeler Environment & Infrastructure, Inc.
511 Congress St., Suite 200, Portland, ME 04101, USA
T +01 207 775 5401 D +01 207 828 3426 M +01 207 776 4251 VOIP #709 3426
stuart.pearson@amecfw.com amecfw.com